

# Delta Outflows Workshop Straw Man Charge

August 13, 2013

## Workshop Purpose

The purpose of this workshop is to identify the best available science to inform the State Water Board's decisions regarding Delta outflow objectives. An independent panel of science experts will be provided the necessary scientific literature and presentations to assess the state of scientific knowledge pertaining to appropriate indicators of Bay-Delta ecosystem condition, the likely responses of the ecosystem to a range of Delta outflows, functional flows for the protection of fish and wildlife beneficial uses, and interactions of non-flow factors with Delta outflow objectives.

The panel will evaluate and synthesize this information in a written report to the Delta Stewardship Council/Delta Science Program and State Water Board.

## Background

The State Water Board is in the process of conducting a phased review and update of the 2006 Water Quality Control Plan for the San Francisco/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan) to protect beneficial uses of water in the Bay-Delta. The Bay-Delta Plan identifies beneficial uses of water in the Bay-Delta, water quality objectives for the reasonable protection of those beneficial uses, and a program of implementation for achieving the water quality objectives. Phase 1 of that review is focused on southern Delta water quality and San Joaquin River flows. Phase 2 (Comprehensive Review) is focused on other changes that may be needed to the remainder of the Bay-Delta Plan to protect fish and wildlife beneficial uses.

As part of Phase 2, the State Water Board held the following technical workshops:

Date	State Water Board Workshop
September 5 and 6, 2012	Ecosystem Changes and the Low Salinity Zone
October 1 and 2, 2012	Bay-Delta Fishery Resources
November 13 and 14, 2012	Analytical Tools for Evaluating the Water Supply, Hydrodynamics, and Hydropower Effects of the Bay-Delta Plan

The workshops were facilitated by the State Water Board's consultant Dr. Brock Bernstein. In January 2013, Dr. Bernstein, in cooperation with ICF International, released a draft report summarizing the workshops' key points, including areas of agreement and disagreement, sources of disagreement and degree of certainty. In July 2013, Dr. Bernstein released the final report, which is comprised of the draft report and comments submitted on the draft report.

At its April 9, 2013 meeting, the State Water Board held an informational item on next steps related to the draft summary report. The purpose of the informational item was to receive input on the next steps for Phase 2. More specifically, the State Water Board sought input on what areas of disagreement or uncertainty identified in the summary report should be resolved during the comprehensive review of the Bay-Delta Plan, and what process should be used to resolve those issues. At the informational item, Dr. Peter Goodwin, Lead Scientist for the Delta Stewardship Council's Science Program recommended that the Delta Science

↓

Program (DSP) hold a series of technical workshops to review and synthesize the best available scientific information to inform the State Water Board. Consequently, the DSP proposed the following four workshops that will focus on critical questions arising from the State Water Board's fall 2012 workshops:

1. Fish Predation on Central Valley Salmonids in the Bay-Delta Watershed<sup>2</sup>
2. Delta Outflows and Other Non-Flow Related Factors
3. Interior Delta Flow Operational Parameters and Other Non-Flow Related Factors
4. Effects of Nutrient Enrichment in the Bay-Delta Ecosystem

## **Regulatory Context**

The State Water Board is required by law to establish flow and other objectives that ensure the reasonable protection of beneficial uses, including fish and wildlife, municipal, agricultural and power beneficial uses. For any flow objective to be reasonable, the State Water Board must consider and balance all competing uses of water in its decision-making. More broadly, the State Water Board will factor in relevant water quality, water rights and habitat needs as it considers potential changes to its Bay-Delta objectives.

## **Charge to the Panel**

The Panel is charged with reviewing and assessing the provided written materials and presentations in order to identify the best available science to inform the State Water Board's Delta outflow decisions. The Panel will evaluate and synthesize the best available scientific information and prepare a report that addresses the following questions:

1. What indicators should the State Water Board use to evaluate the effectiveness of the Delta outflow and other associated water quality objectives addressed through this workshop?
  - How can we better capture the status of the ecosystem as a whole?
  - How should the monitoring and special studies program be improved?
2. How is the ecosystem likely to respond to a range of Delta outflows between the current Delta outflows and those suggested in the State Water Board's 2010 Delta Flow Criteria Report?
  - What scales (frequency, magnitude and duration) of outflow change are needed to produce measurable changes in specific ecosystem responses including protection of fish and wildlife beneficial uses? Could adaptive management experiments be conducted on these scales to inform State Water Board flow decisions?
  - What can historical relationships between outflow and ecosystem characteristics (e.g., fish and invertebrate distribution and abundance) tell us about current and future relationships?
  - To what degree is there a conflict between Delta outflow objectives and protection of upstream fish and wildlife beneficial uses (e.g., cold water pool, prevention of stranding and redd dewatering) absent water supply considerations?
3. How should Delta outflow be measured and managed to better reflect the functional flows necessary to protect fish and wildlife beneficial uses?
  - Is a monthly timestep sufficient for the protection of fish and wildlife beneficial uses? Or is it necessary to use a 14-day, weekly or daily timestep? If so, is it

necessary to manage Delta outflow at the shorter timestep on a year-round basis or only during key periods?

- To what extent does managing outflow by X2 reflect the functional flows necessary to protect fish and wildlife beneficial uses in the low salinity zone? Are there better indices of Delta outflow that could improve our ability to assess ecosystem impacts and better represent the ecosystem goals?
4. How are other factors that may affect the ecosystem likely to interact with Delta outflow requirements?
    - What combinations of Delta outflow and habitat restoration are most likely to protect fish and wildlife beneficial uses?
    - Can we reasonably expect that addressing other stressors without addressing flow will lead to measurable improvements in ecosystem condition?
    - How important has climate change been in recent changes to Delta outflow?
    - Please comment on any other specific factors raised in the materials or presentations.
  5. Please comment on the relative strength of the science presented. What are the key studies and synthesis reports that the State Water Board should rely on in making their flow objective decisions?

## **Final Deliverable**

The panel will produce a report addressing the above questions and advising the State Water Board on the best available science to inform its Delta outflow decisions.

## **Materials**

### *General Background*

ICF. 2013. Final Bay-Delta Plan Workshops Summary Report.

[http://www.waterboards.ca.gov/waterrights/water\\_issues/programs/bay\\_delta/bay\\_delta\\_plan/docs/bdwrkshprpt070813.pdf](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/docs/bdwrkshprpt070813.pdf)

IEP. 2012. Draft 2012 FLaSH study report.

[http://deltacouncil.ca.gov/sites/default/files/documents/files/FLaSH\\_combined\\_7\\_0\\_12.pdf](http://deltacouncil.ca.gov/sites/default/files/documents/files/FLaSH_combined_7_0_12.pdf)

SWRCB. 2010. Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem.

[http://www.waterboards.ca.gov/waterrights/water\\_issues/programs/bay\\_delta/deltaflow/docs/final\\_rpt080310.pdf](http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf)

USEPA, 2012. Workshop Summary: Technical Workshop on Estuarine Habitat in the Bay Delta Estuary. Convened by USEPA 3/27/2012. Report prepared by Dr. Brock Bernstein.

USFWS. 2008. Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP), - RPA Component 3, pp. 282-283.

[http://www.fws.gov/sfbaydelta/documents/SWP-CVP\\_OPs\\_BO\\_12-15\\_final\\_OCR.pdf](http://www.fws.gov/sfbaydelta/documents/SWP-CVP_OPs_BO_12-15_final_OCR.pdf)

### *Peer-reviewed Literature*

Bennett WA. 2005. Critical assessment of the delta smelt population in the San Francisco Estuary, California. San Francisco Estuary and Watershed Science 3(2):1.

Bennett WA, WJ Kimmerer, JR Burau. 2002. Plasticity in vertical migration by native and exotic estuarine fishes in a dynamic low-salinity zone. *Limnology and Oceanography* 47:1496-1507.

Dugdale RC, FP Wilkerson, VE Hogue, A Marchi. 2007. The role of ammonium and nitrate in spring bloom development in San Francisco Bay. *Estuarine, Coastal and Shelf Science* 73(1- 2):17-29.

Enright C, SD Culberson. 2009. Salinity trends, variability, and control in the northern reach of the San Francisco Estuary. *San Francisco Estuary and Watershed Science* 7(2):3.

Feyrer F, K Newman, M Nobriga, T Sommer. 2011. Modeling the effects of future outflow on the abiotic habitat of an imperiled estuarine fish. *Estuaries and Coasts* 34:120-128.

Feyrer F, ML Nobriga, TR Sommer. 2007. Multi-decadal trends for three declining fish species: habitat patterns and mechanisms in the San Francisco Estuary, California, USA. *Canadian Journal of Fisheries and Aquatic Sciences* 64(4):723-734.

Hobbs JA, WA Bennett, JE Burton. 2006. Assessing nursery habitat quality for native smelts (*Osmeridae*) in the low-salinity zone of the San Francisco Estuary. *Journal of Fish Biology* 69:907-922.

Jassby AD. 2008. Phytoplankton in the Upper San Francisco Estuary: recent biomass trends, their causes and their trophic significance. *San Francisco Estuary and Watershed Science* 6(1):2.

Jassby AD, WJ Kimmerer, SG Monismith, C Armor, JE Cloern, TM Powell, JR Schubel, TJ Vendlinski. 1995. Isohaline position as a habitat indicator for estuarine applications. *Ecological Applications* 5(1):272-289.

Kimmerer WJ. 2002. Effects of freshwater flow on abundance of estuarine organisms: physical effects or trophic linkages? *Marine Ecology and Progress Series* 243:39-55.

Kimmerer W. 2004. Open Water Processes of the San Francisco Estuary: From Physical Forcing to Biological Responses. *San Francisco Estuary and Watershed Science* 2(1):1.

Kimmerer WJ. 2005. Long-term changes in apparent uptake of silica in the San Francisco estuary. *Limnology and Oceanography* 50:793-798.

Kimmerer WJ. 2006. Response of anchovies dampens effects of the invasive bivalve *Corbula amurensis* on the San Francisco Estuary foodweb. *Marine Ecology Progress Series* 324:207- 218.

Kimmerer WJ, WA Bennett, JR Burau. 2002. Persistence of tidally-oriented vertical migration by zooplankton in a temperate estuary. *Estuaries* 25:359-371.

Kimmerer WJ, ES Gross, ML MacWilliams. 2009. Is the response of estuarine nekton to freshwater flow in the San Francisco Estuary explained by variation in habitat volume? *Estuaries and Coasts* 32:375-389.

MacNally R, JR Thomson, WJ Kimmerer, F Feyrer, KB Newman, A Sih, WA Bennett, L Brown, E Fleishman, SD Culberson, G Castillo. 2010. An analysis of pelagic species decline in the upper San Francisco Estuary using multivariate autoregressive modeling. *Ecological Applications* 20(5):1417-1430.

Maunder, MN, RB Deriso. 2011. A state-space multistage life cycle model to evaluate population impacts in the presence of density dependence: illustrated with application to Delta Smelt (*Hypomesus transpacificus*). *Canadian Journal of Fisheries and Aquatic Sciences* 68:1285-1306.

Monismith SG, WJ Kimmerer, JR Burau, MT Stacey. 2002. Structure and flow-induced variability of the subtidal salinity field in northern San Francisco Bay. *Journal of Physical Oceanography* 32:3003-3019.

Nobriga M, T Sommer, F Feyrer, K Fleming. 2008. Long-term trends in summertime habitat suitability for delta smelt, *Hypomesus transpacificus*. *San Francisco Estuary and Watershed Science* 6(1):1.

Ruhl CA, DH Schoellhamer. 2004. Spatial and temporal variability of suspended-sediment concentrations in a shallow estuarine environment. *San Francisco Estuary and Watershed Science* 2(2):1.

Schoellhamer, DH. 2001. Influence of salinity, bottom topography, and tides on locations of estuarine turbidity maxima in northern San Francisco Bay, in McAnally, W.H. and Mehta, A.J., ed., *Coastal and Estuarine Fine Sediment Processes*. Elsevier, Amsterdam, The Netherlands.

Schoellhamer DH. 2011. Sudden clearing of estuarine waters upon crossing the threshold from transport to supply regulation of sediment transport as an erodible sediment pool is depleted: San Francisco Bay, 1999. *Estuaries and Coasts* 34:885-899

Thomson JR, WJ Kimmerer, LR Brown, KB Newman, R Mac Nally, WA Bennett, F Feyrer, E Fleishman. 2010. Bayesian change point analysis of abundance trends for pelagic fishes in the upper San Francisco Estuary. *Ecological Applications* 20(5):1431-1448.

Winder M, AD Jassby. 2011. Shifts in zooplankton community structure: implications for food web processes in the upper San Francisco Estuary. *Estuaries and Coasts* 34:675-690.

York J, B Costas, G McManus. 2010. Microzooplankton grazing in green water—results from two contrasting estuaries. *Estuaries and Coasts* 34:373-385.

#### Optional additional reading

NRC. 2010. A Scientific Assessment of Alternatives for Reducing Water Management Effects on Threatened and Endangered Fishes in California's Bay Delta.

NRC. 2012. Sustainable Water and Environmental Management in the California Bay-Delta.